

**INSTALLATION AND SERVICE
MANUAL**

**HP 12990A
MEMORY EXTENDER**

Manual Part No. 12990-90003
Microfiche Part No. 12990-90005

Printed: JAN 1976

HEWLETT  PACKARD

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PRELIMINARY

OPTIONS COVERED

This manual covers option 015 as well as the basic memory extender.

LIST OF EFFECTIVE PAGES

Changed pages are identified by a change number adjacent to the page number. Changed information is indicated by a vertical line in the outer margin of the page. Original pages do not include a change number and are indicated as change number 0 on this page. Insert latest changed pages and destroy superseded pages.

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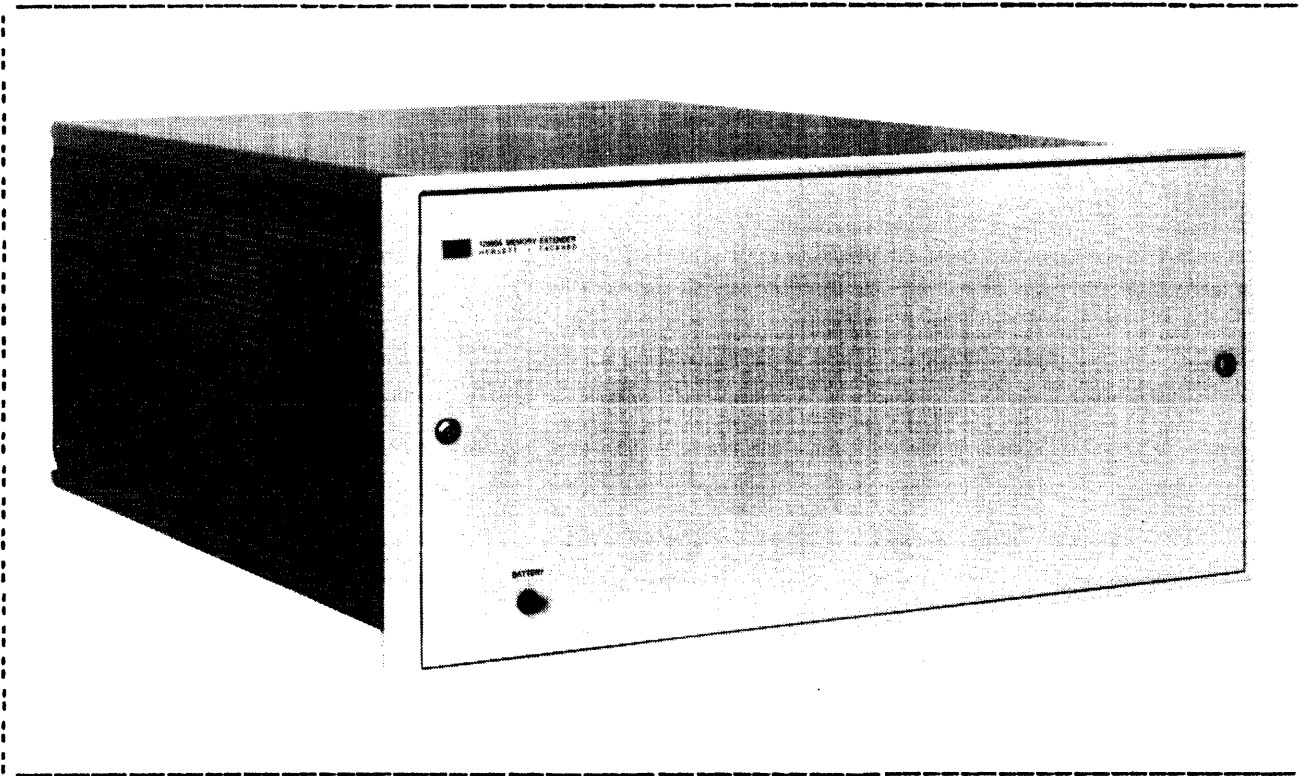


Figure 1-1. HP 12990A Memory Extender

The HP 12990A Memory Extender provides for the expansion of the memory capacity of HP 21MX Computers equipped with an HP 12976A Dynamic Mapping System. The extender has an internal power supply and space for eight semiconductor memory modules. Up to 65,536 words of memory may be added using 8k modules.

1-1. EQUIPMENT SUPPLIED

The memory extender (figure 1-1) is shipped with the following items:

- a. Power control cable assembly, part no. 12990-60014.
- b. Extended memory system cable assembly, part no. 12990-60011.
- c. Two ground strap cable assemblies, part no. 5061-1342.

1-2. SPECIFICATIONS

Specifications for the HP 12990A Memory Extender are provided in table 1-1.

1-3. OPTIONS AND ACCESSORIES

The following options and accessories are available for the memory extender:

- a. 220V, 50-Hz power option (option 015).
- b. HP 12991A Power Fail Recovery System.
- c. HP 12903B Chassis Slide Kit.

Table 1-1. Specifications

PHYSICAL CHARACTERISTICS

Width:	16-3/4 in. (42.55 cm) behind rack mount; 19 in. (48.26 cm) front panel width on sides.
Height:	8-3/4 in. (22.23 cm) in rack mount.
Depth:	23-1/2 in. (59.69 cm) overall; 23 in. (58.42 cm) behind rack-mounting ears.
Weight:	40 lb (18.15 kg)

ELECTRICAL CHARACTERISTICS

Input Line Voltage:	110V or 220V ac ($\pm 20\%$), single phase.
Line Frequency:	47.5 to 66Hz.
Power Dissipation:	300W maximum
Line Overvoltage Protect:	Input crowbar trips at line voltage 40% above nominal.
Output Protect:	All voltages protected against overvoltage and overcurrent.
Output Voltage Regulation:	$\pm 5\%$
Thermal Sensing:	Monitors internal temperature and automatically shuts down if temperature exceeds safe level.

ENVIRONMENT LIMITATIONS

Ambient Temperature:	Operating: 0° to 55°C (32° to 131°F). Nonoperating: -40° to 75°C (-40° to 167°F).
Altitude:	Operating: 15,000 feet (4,573 meters). Nonoperating: 50,000 feet (15,244 meters).

Table 1-1. Specifications (Continued)

Relative Humidity:	20% to 95% at 104°F (40°C), non-condensing.
Vibration and Shock:	Type tested to qualify for normal shipping and handling vibration and shock. Contact factory for any application regarding operation under continuous vibration.
VENTILATION	
Air Flow:	Intake on left-hand side and exhaust on right-hand side.
Heat Dissipation:	1024 BTU's (258 kilocalories)/hour.
POWER FAIL RECOVERY SYSTEM (HP 12991A)	
Power Restart:	Detects resumption of power and generates an interrupt to trap cell for user written restart program which has been protected in memory by the sustaining batteries.
Power Control and Charger:	Monitors battery charge status and provides trickle charge.
Sustaining Batteries:	Type: 12V nickel cadmium (two) Charging Rate: 350 milliamperes. Capacity: Will sustain eight modules of memory for at least two hours.

This section provides installation instructions for the HP 12990A Memory Extender. Included in these instructions are site preparation data, unpacking and inspection details, configuration requirements, installation procedures, performance verification, and recommended packing and shipping methods.

2-1. SITE PREPARATION

Site preparation information for the memory includes environmental limitations, power requirements, and mounting considerations. If the extender is purchased as part of a computer system, disregard the contents of paragraphs 2-2 through 2-5 herein and refer instead to the Hewlett-Packard 2000 Computer Systems Site Preparation Manual, part no. 02000-90097.

2-2. ENVIRONMENTAL LIMITATIONS

Environmental limitations for operating and nonoperating conditions of the extender are specified in table 1-1.

2-3. POWER REQUIREMENTS

The extender is shipped with the power supply configured to operate from single-phase power mains of $110 \pm 20\%$ volts (standard) or $220 \pm 20\%$ volts (option 015) as specified on the purchase order. The maximum power dissipation is 300 watts.

Various safety codes require that instrument chassis, panels, and housing be grounded to protect operating and service personnel. A grounded three-conductor female outlet must be available to satisfy this requirement.

2-4. COOLING REQUIREMENTS

There are no external cooling requirements for the extender. Two internal fans provide adequate ventilation when operated within the environmental limitations specified in table 1-1.

2-5. MOUNTING CONSIDERATIONS

The extender and the computer can be used freestanding or mounted in a standard 19-inch (483-millimeter) equipment rack. In either case, the extender must be mounted directly below and adjacent to the computer due to cabling limitations. Rack-mounting dimensions for the extender are specified in table 1-1.

2-6. UNPACKING AND INSPECTION

Inspect the shipping container immediately upon receipt for evidence of mishandling during transit. If the container is damaged or water stained, request the carrier's agent be present when the container is opened.

Unpack the extender and inspect it for external damage such as broken connectors, dented corners, bent panels, and scratches. Check also the packaging material for signs of deformation which could be indicative of rough handling during transit. If the extender includes the HP 12991A Power Fail Recovery System, ensure that battery printed-circuit assembly (PCA), figure 4-1, index no. 21, is seated fully into mating receptacle on lower power supply PCA.

If the visual inspection reveals any damage to the extender, follow the damage claim procedure described in paragraph 2-23. Save the shipping container and packing material for examination in the settlement of claims or for future use.

2-7. INSTALLATION PROCEDURE

2-8. TOOLS AND TEST EQUIPMENT

No tools other than ordinary hand tools are required for installation. Test equipment required to verify the adequacy of the ac mains voltage and for power supply adjustments are listed in table 2-1.

Table 2-1. Installation Test Equipment

INSTRUMENT	CRITICAL SPECIFICATIONS	RECOMMENDED HP MODEL
Digital Voltmeter	At least four-digit readout. Minimum input impedance 10 megohms; full-scale ranges of 0.999 and 99.99 volts dc.	HP 3439A Digital Voltmeter with HP 3441A Range Selector.
AC Voltmeter	Expanded-scale or digital readout type capable of measuring ac power mains to $\pm 1.0\%$. Voltage range must be from 88 to 132 volts ac (standard) or 176 to 264 volts ac (option 015).	HP3445 AC/DC Range Unit. (Also performs functions of HP 3441A Range Selector listed above. Requires an HP 3439A Digital Voltmeter.)

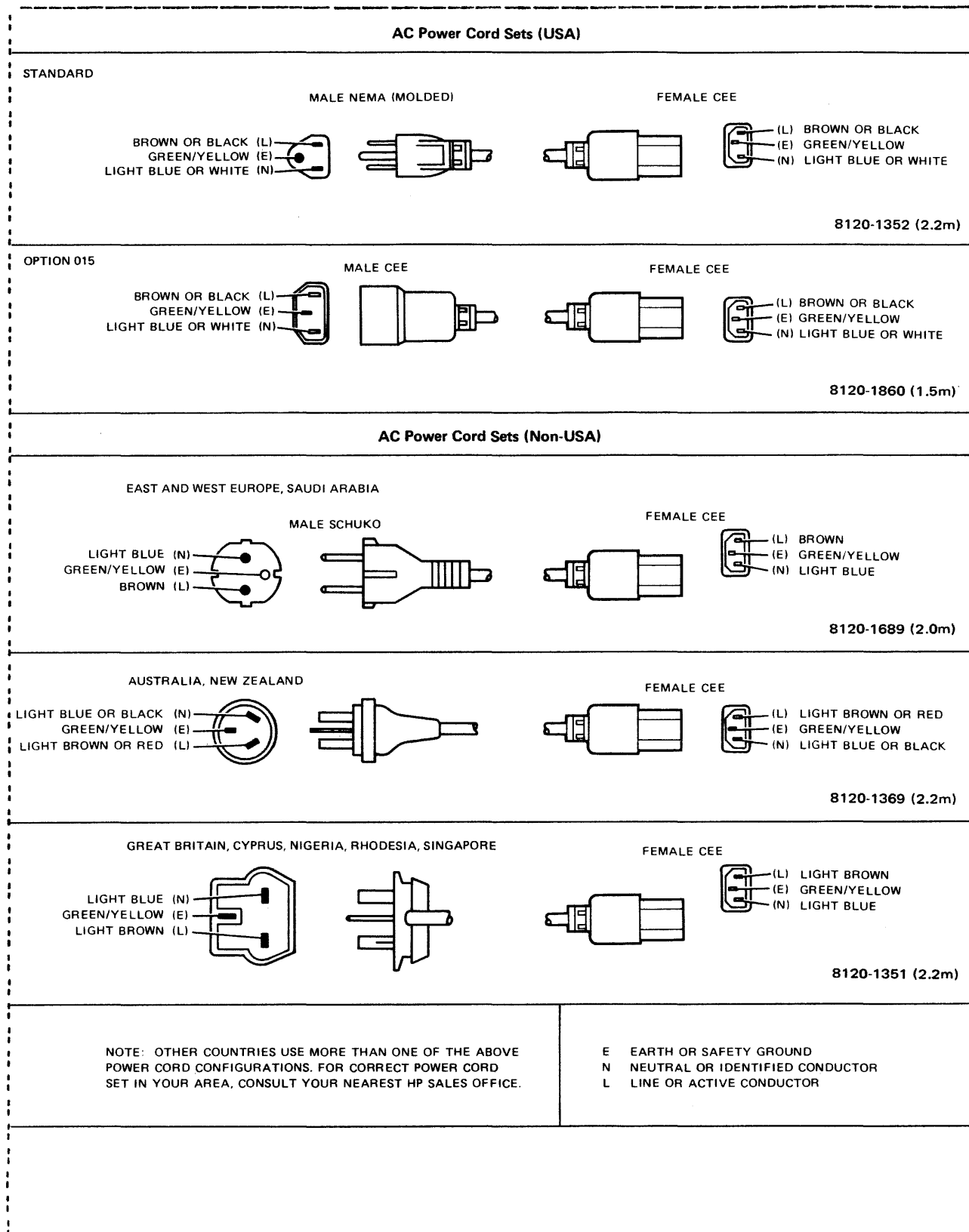
2-9. AC POWER MAINS OUTLET AND EXTERNAL GROUND

The female power outlet to be used to supply ac mains power to the extender must be checked with an ac voltmeter by a qualified electrician to ensure that it furnishes the proper single-phase voltage for which the extender is configured. The outlet and its associated wiring and fuses (or circuit breakers) must be capable of carrying the current specified on the identification label on the extender rear panel. If the extender is configured for 110-volt operation, the mains voltage must be in the range of 88 to 132 volts ac (rms); for 220-volt operation, the main voltage must be in the range of 176 to 264 volts ac (rms). Bear in mind that the electrical load imposed by the extender and memory modules may reduce the line voltage below the no-load value.

If the line voltage is in the correct range, have the electrician also check the power outlet to ensure that it is wired correctly with respect to ac high potential, ac neutral, and earth ground. If the outlet is wired improperly, correction must be made by a qualified electrician. Local electrical codes must be observed if the installation is inside a building.

For safety reasons, it is mandatory that a connection be made between the extender chassis and earth ground. For installation in a mobile environment (e.g., ship, aircraft, or train), the earth ground wire in the extender ac power cord must be connected to the hull or metal frame of the vehicle.

Figure 2-1 illustrates and provides the necessary details of the various ac power cord configurations. If the extender is to be installed in a building, make sure that the power cord furnished with the extender complies with local electrical codes.



7098-11

Figure 2-1. AC Power Cord Sets

2-10. EXTENDER MOUNTING

2-11. PRELIMINARY PROCEDURE. Before mounting the extender, interchange the computer and extender bottom covers as follows:

WARNING

Hazardous voltages are exposed when the bottom cover of the computer is removed and ac power is applied.

CAUTION

All contents of memory will be lost when the mains (line) and battery voltages are both off. Therefore, before proceeding, ensure that any contents of memory to be saved are stored in another medium for later retrieval.

- a. Loosen screw in rear fold of extender bottom cover; slide cover toward the rear and remove.
- b. Set computer ~LINE and BATTERY switches to OFF. Loosen screw in rear fold of computer bottom cover; slide cover toward rear and remove.
- c. Interchange extender and computer bottom covers and secure in place by tightening screw in rear fold of each cover.

2-12. Internal Battery Cables. If a power fail recovery system is installed in the extender, proceed as follows:

- a. Set extender BATTERY switch to EXT (external) position, which is effectively the "off" position when external batteries are not connected.
- b. Loosen screw in rear fold of top cover; slide cover toward rear and remove.
- c. Connect battery cables to the two connectors located on inside of rear panel. Replace top cover and tighten screw in rear fold.

2-13. Ground Cables. If your computer has a serial number prefix less than 1003, it will be necessary to install ground cable(s) assembly, part no. 5061-1342 in the computer. To install the ground cable(s), proceed as follows:

WARNING

Hazardous voltages are exposed when the top cover of the computer is removed and ac power is applied. Before proceeding, set ~LINE and BATTERY switches to OFF and disconnect the power cord.

CAUTION

All contents of memory will be lost when the mains (line) and battery voltages are both off. Therefore, before proceeding, ensure that any contents of memory to be saved are stored in another medium for later retrieval.

- a. Set ~LINE and BATTERY switches to OFF and remove power cord.
- b. Loosen screw in rear fold of computer top cover; slide cover toward the rear and remove.
- c. Connect the lug of the ground cable to a ground terminal on the crossover PCA as shown in figure 2-2. Some HP 2108A computers have terminal screws inserted from the bottom of the crossover PCA. If you have such a computer, remove the screw from one of the crossover PCA ground terminals, slide the terminals off of the PCA edge, reverse the terminal and secure it and the ground wires to the PCA by inserting the screw on top.
- d. Remove the four mounting screws and lockwashers that secure voltage distribution panel to computer frame. (Two screws are located at the top of the panel and two screws are located at the bottom of the panel.)
- e. Carefully swing the voltage distribution panel outward to expose terminal block TBI and other components mounted on this panel.
- f. For the HP 2108A, insert the ground cable's three loose ends into the unused holes (pins 7, 8, and 9) of the PWR CONT connector on the inside rear of the voltage distribution panel. For the HP 2112A, two cables must be used; one for the PWR CONT IN connector and one for the PWR CONT OUT connector.
- g. Position voltage distribution panel in place and secure with the four mounting screws and lockwashers. Replace top cover of computer.

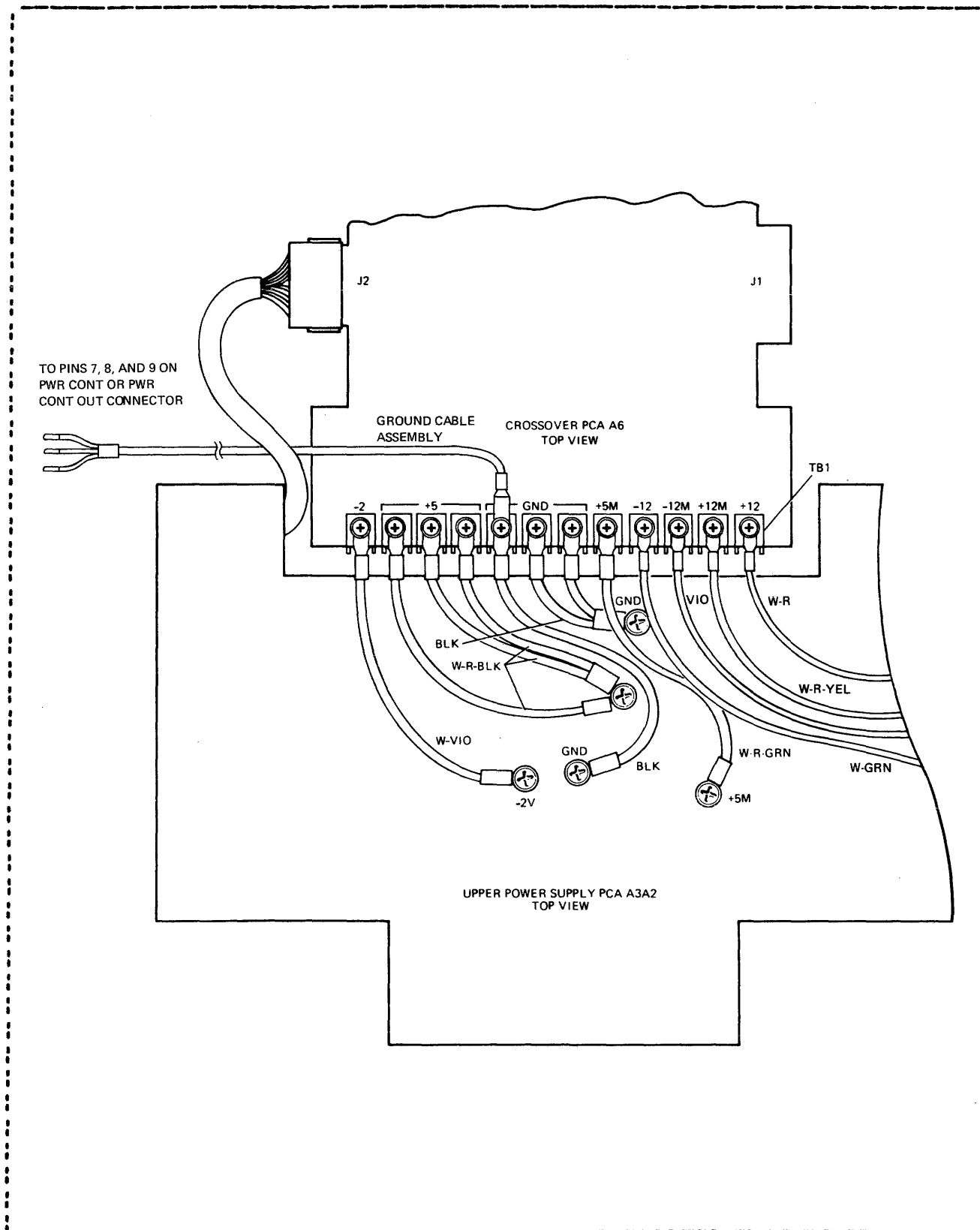


Figure 2-2. Typical Computer Crossover PCA Power Connections

2-14. BENCH MOUNTING. If the computer is bench mounted, the memory extender must also be bench mounted due to the cabling restrictions. In a bench-mounted application, the computer is mounted on top of and supported by the extender. The only consideration here is that adequate space be allowed on each side of the computer and extender to ensure full intake and exhaust of ventilating air. Also bear in mind that a minimum clearance of 12 inches (30 centimeters) behind the computer is required when removing and installing input/output interface PCA's.

2-15. RACK MOUNTING. If the extender is to be rack mounted, it is recommended that both it and the computer be mounted with separate HP 12903B/C Chassis Slide Kits. If an HP 12903B/C Chassis Slide Kit has been ordered, rack mount the extender as follows:

- a. Following the instructions furnished with the chassis slide kit, mount the kit components to the sides of the memory extender and to the inside of the rack.
- b. Install the extender in the rack and secure in place with screws inserted through the mounting holes identified in figure 2-3.

Note: The extender is light enough to allow installation in the rack without being supported by any means other than the rack-mounting screws. However, it is recommended that additional support be provided by chassis slides or slide rails.

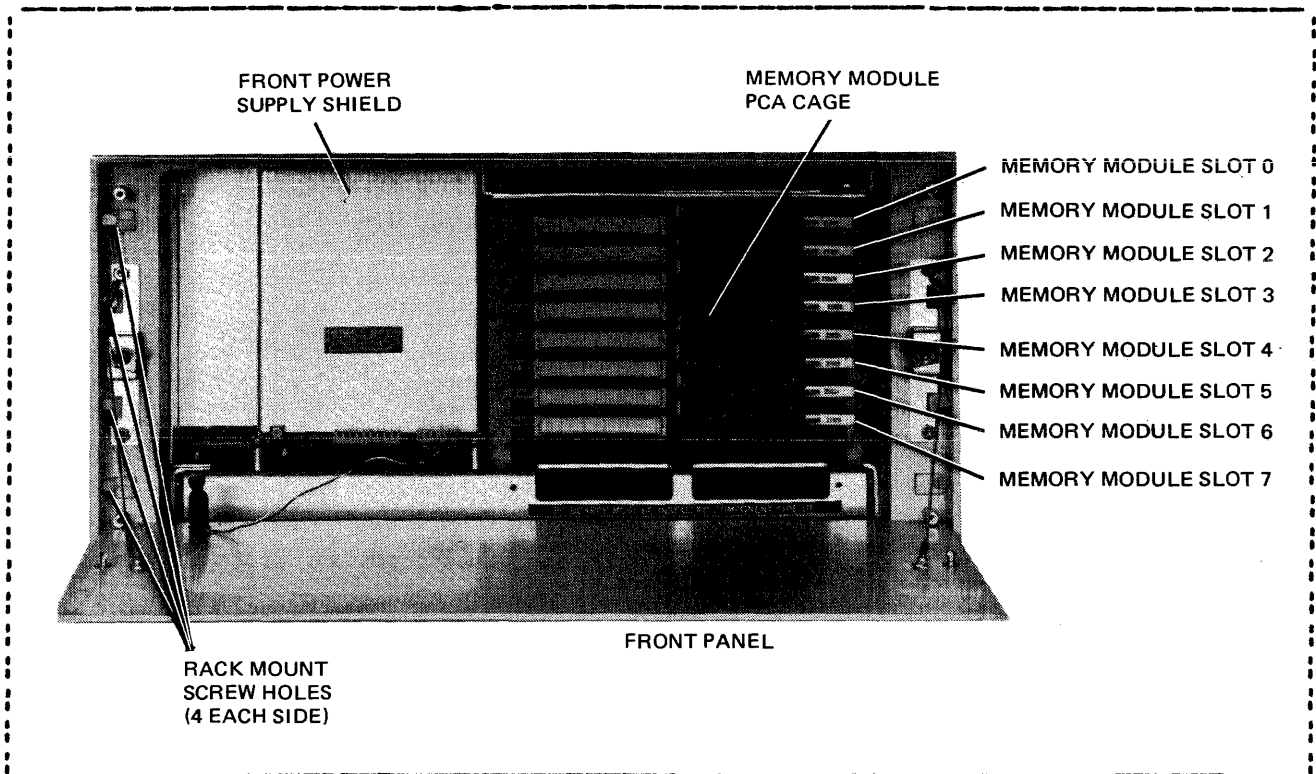


Figure 2-3. HP 12990A Memory Extender Front View

2-16. MEMORY MODULE INSTALLATION

Install memory modules in the memory extender as follows:

CAUTION

All contents of memory will be lost when the mains (line) and battery voltages are both off. Therefore, before proceeding with the installation, ensure that any contents of memory to be saved are stored in another medium for later retrieval.

- a. On extender rear panel, set $\sim$ LINE switch to OFF. If an internal battery is installed, set BATTERY switch to EXT; if external batteries are used, set BATTERY switch to INT. If both internal and external batteries are used, disconnect the external ones and set BATTERY switch to EXT.
- b. On computer rear panel, set $\sim$ LINE and BATTERY switches to OFF.
- c. Loosen quarter-turn fasteners on memory extender front panel and lower it to memory access position. (See figure 2-3.) Remove memory PCA cage cover by removing the two screws and lockwashers.

- d. Loosen quarter-turn fasteners on computer front panel and lower it to memory access position. Remove memory PCA cage cover by removing the two screws and lockwashers.
- e. Remove the existing memory system cable present in computer. If necessary, remove memory controller and reinstall in the highest numbered computer memory slot; i.e., slot 118 (HP 2108A) or slot 123 (HP 2112A).
- f. Assign consecutive memory module numbers, beginning with module 0, to the 8K memory modules. Make the module number assignments by installing 8K module XW1 jumpers as specified in figure 2-4.
- g. If a half-loaded memory module (i.e., 4K) is present, assign it the highest module number in the system and install XW1 jumper as specified in figure 2-5.
- h. Install the memory modules in the extender and the computer. For best power supply loading in both units, install the first memory module in the computer, the next eight modules in the extender, and any remaining modules in the computer. At least one memory module must be installed in the computer. Refer to figure 2-6 for a typical memory system installation.

2-17. CABLE CONNECTIONS

2-18. MEMORY SYSTEM CABLE. The extended memory system cable, part no. 12990-60011, includes seventeen 50-pin connectors. A space is included between the eighth and ninth connectors to account for the space existing between the memory controller in the computer and the topmost memory module in the extender. Connect the extended memory system cable as follows:

- a. If you have an HP 2108A Computer, take a sharp knife or pair of scissors and cut the last four connectors off of the 9-connector half of the cable.
- b. Gain access to memory PCA cages in computer and memory extender.
- c. Pass eight cable connectors through bottom of computer and top of extender.
- d. Connect cable to edge connector J1 on memory controller and to J1 on all memory modules.

2-19. POWER CONTROL CABLE. Connect one end of power control cable assembly, part no. 12990-60014, to PWR CONT or PWR CONT OUT connector on computer rear panel; connect free end of cable to PWR CONT IN connector on extender rear panel. (See figure 2-7.)

Note: The power control cable must be installed to ensure a common ground reference for the internal voltages in the computer and the memory extender.

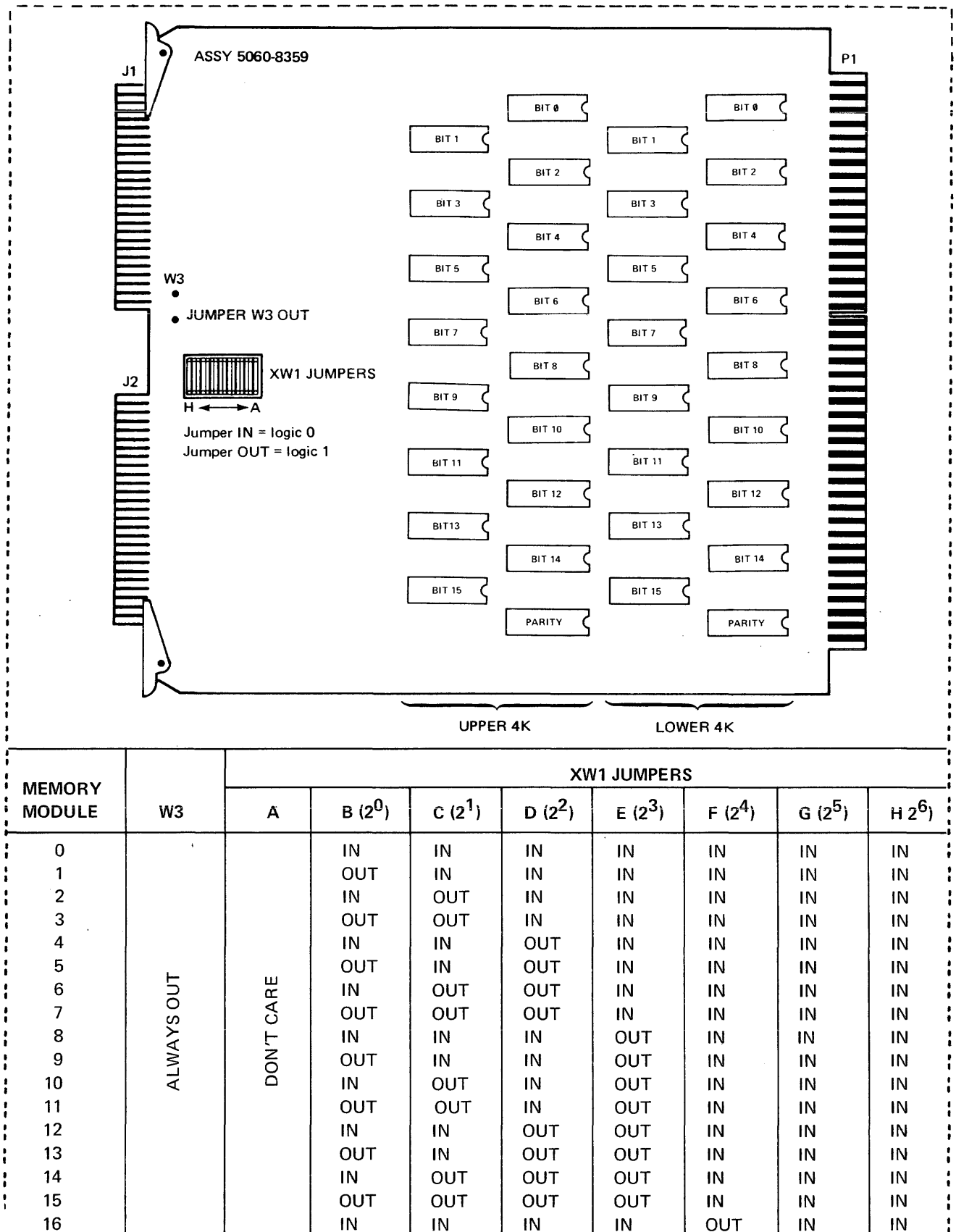


Figure 2-4. HP 2102A 8K Memory Module Address Jumpers

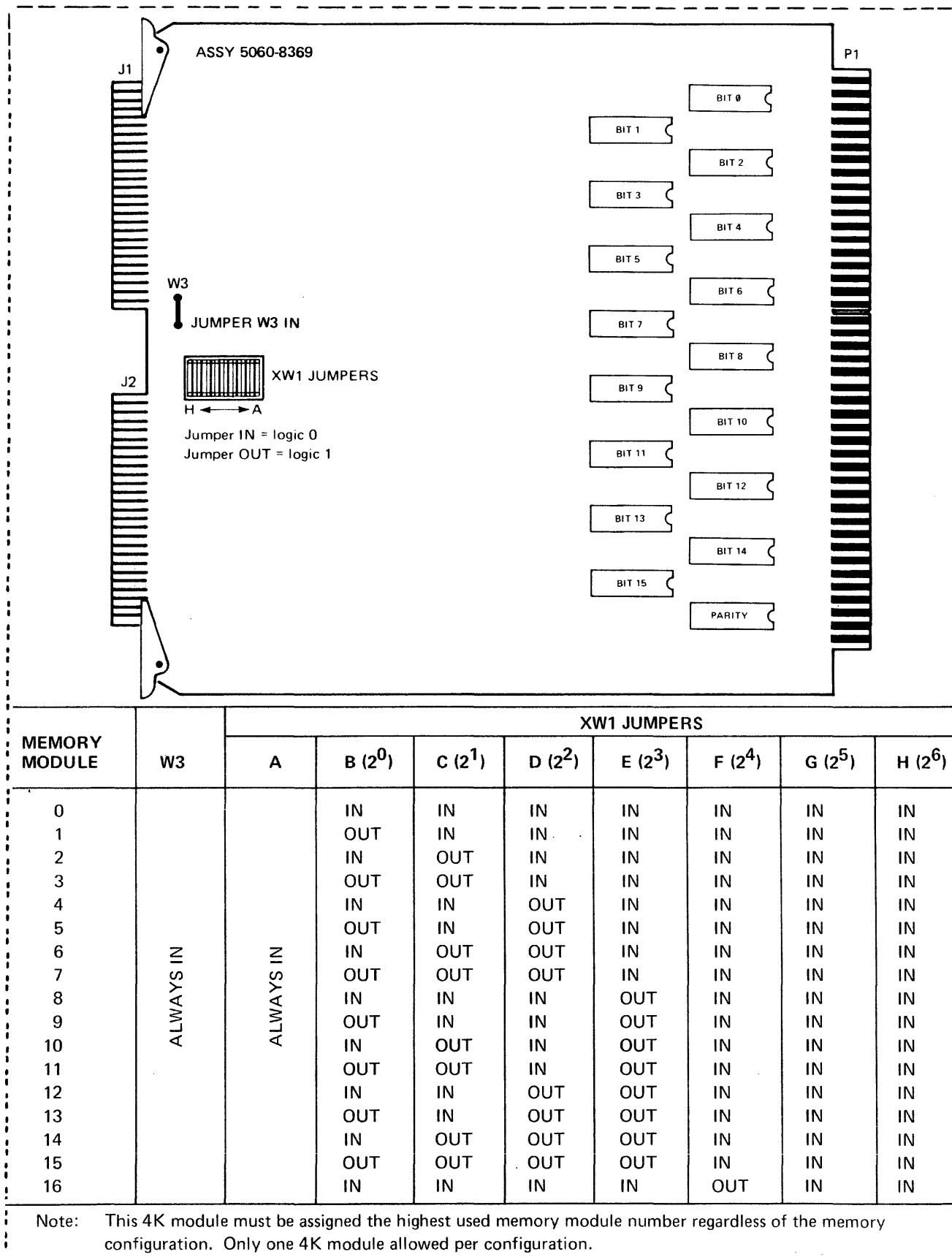
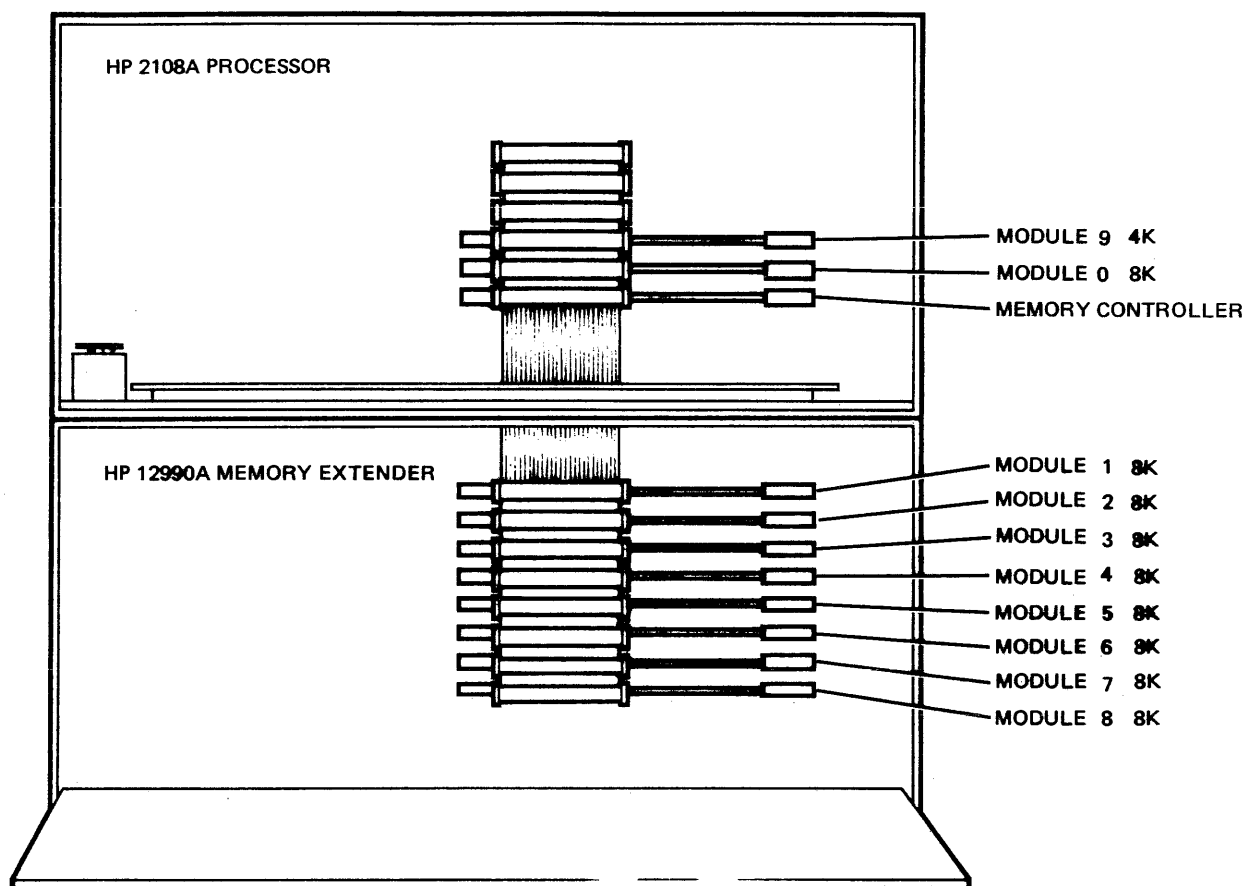
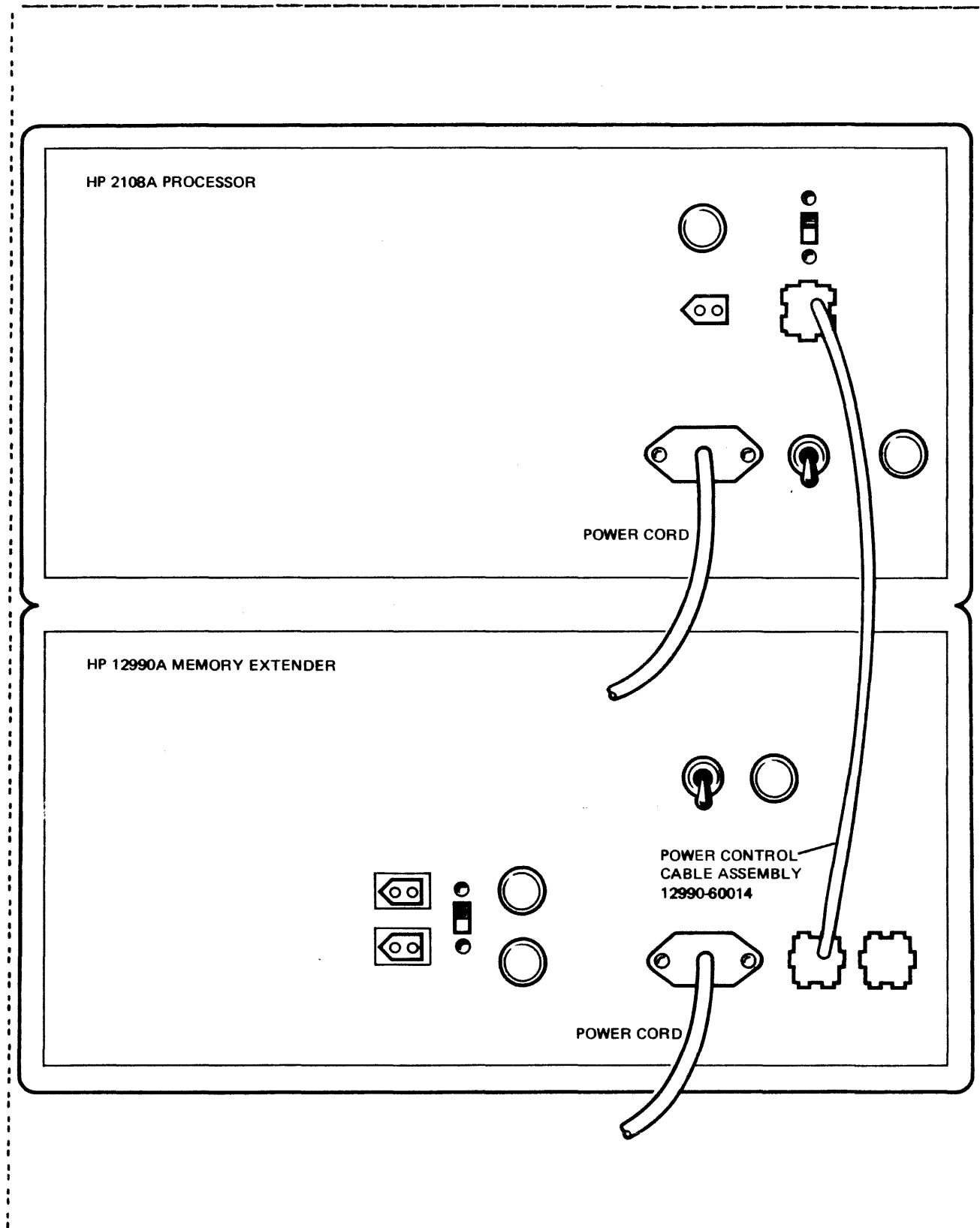


Figure 2-5. HP 2102A 4K Memory Module Address Jumpers

**NOTES:**

1. Memory controller must be installed in highest numbered memory slot in the computer; i.e., slot 118 (HP 2108A) or slot 123 (HP 2112A).
2. Memory module numbers must be assigned consecutively beginning with module 0.
3. At least one memory module must be installed in the computer.
4. If installing a half-loaded module (i.e., 4K), it must be assigned the highest memory module number in the system. Only one half-loaded module is allowed in a system.

Figure 2-6. Typical Memory System Configuration



7098-4

Figure 2-7. Rear Panel Cabling

2-20. EXTERNAL BATTERIES. The following materials are required if a power fail recovery system is not installed and it is desired to sustain memory with two external 12-volt batteries:

CAUTION

The extender provides a charging current of 350 milliamperes to each of the external batteries after they sustain memory and ac power is restored to the extender. Be sure that the external batteries used can accept the battery charging current. Special care must be taken to protect the external batteries' cables and terminals from electrical shorting. Also, be sure that the installation of external batteries complies with local safety codes.

- a. Two two-pin female receptacles, Molex* part no. 03-09-1023.
- b. Four female terminals, Molex part no. 02-09-5110.
- c. Cable as required.
- d. Battery PCA, part no. 02112-60003.

Assemble the two battery cables and observe the polarity and color as shown in figure 2-8. Set extender BATTERY switch to INT (internal) position, which is effectively the "off" position when internal batteries are not connected. Connect the battery cables to the two BAT. INPUT connectors. Insert battery PCA (figure 4-1, index 21) into mating receptacle on lower power supply PCA; the component side of the battery PCA must face the rear of the extender.

2-21. POWER SUPPLY ADJUSTMENTS

Energize the digital voltmeter and allow sufficient warmup time for the instrument to reach its rated accuracy. Plug the extender power cord into the power outlet and proceed as follows:

- a. Loosen quarter-turn fasteners on memory extender front panel and lower it to memory access position.
- b. On rear panel of extender, set ~LINE switch to ON. Set BATTERY switch to INT (internal) or EXT (external) as required to select battery.

*Molex Products Co., 5224 Katrine Ave.,
Downers Grove, Illinois 60515

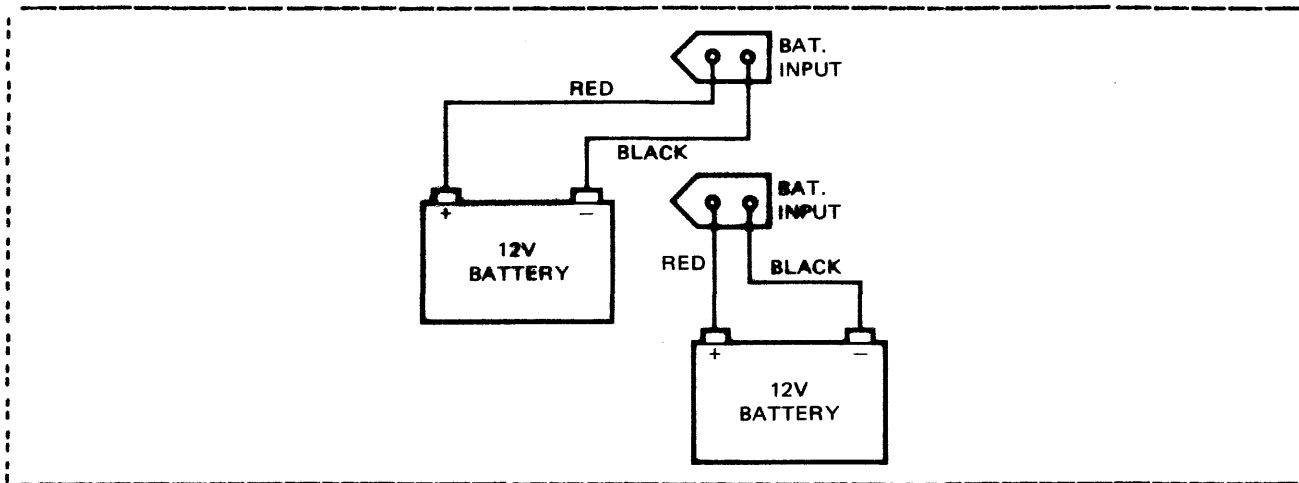


Figure 2-8. External Battery Cabling

- Note: Internal batteries are completely discharged before shipment. Upon initial application of charging voltage, or after a prolonged power failure, the BATTERY indicator will flash on and off for approximately 16 hours until the battery contains a sufficient charge to sustain memory.
- c. On rear panel of computer, set $\sim$ LINE and BATTERY switches to ON.
 - d. On front panel of computer, rotate key-operated switch to R (reset) and then to STANDBY.
 - e. Connect positive lead of digital voltmeter to J6-9 (+12VM test point) and connect common lead to J6-2 (common). (See figure 2-9.)
 - f. Adjust +12VM ADJ potentiometer to obtain voltmeter indication of +12.45 to +12.55 volts. This adjustment must be made with the memory modules installed to provide a power supply load.
 - g. Check tolerances of remaining supplies; test points and tolerances are listed in table 2-2. If any power supply is out of tolerance, notify the nearest Hewlett-Packard Sales and Service Office. Sales and Service Offices are listed at the rear of this manual.
 - h. Disconnect voltmeter, close extender front panel, and secure in place with the quarter-turn fasteners.

Table 2-2. Power Supply Voltage Tolerances

SUPPLY	TEST POINT*	TOLERANCE
PUUP	J6-1	-
Common	J6-2	-
+5V	J6-5	$\pm 0.25V$
+5 VM	J6-6	$\pm 0.25V$
+5V	J6-7	$\pm 0.25V$
+12 VM	J6-9	$\pm 0.6V$
-12 VM	J6-10	$\pm 0.6V$

*J6 is mounted on lower power supply PCA.
(See figure 2-9.)

2-22. PERFORMANCE VERIFICATION CHECK

Verify the system installation and operation as described in the Semiconductor Memory Module Diagnostic Reference Manual, part no. 24395-90001.

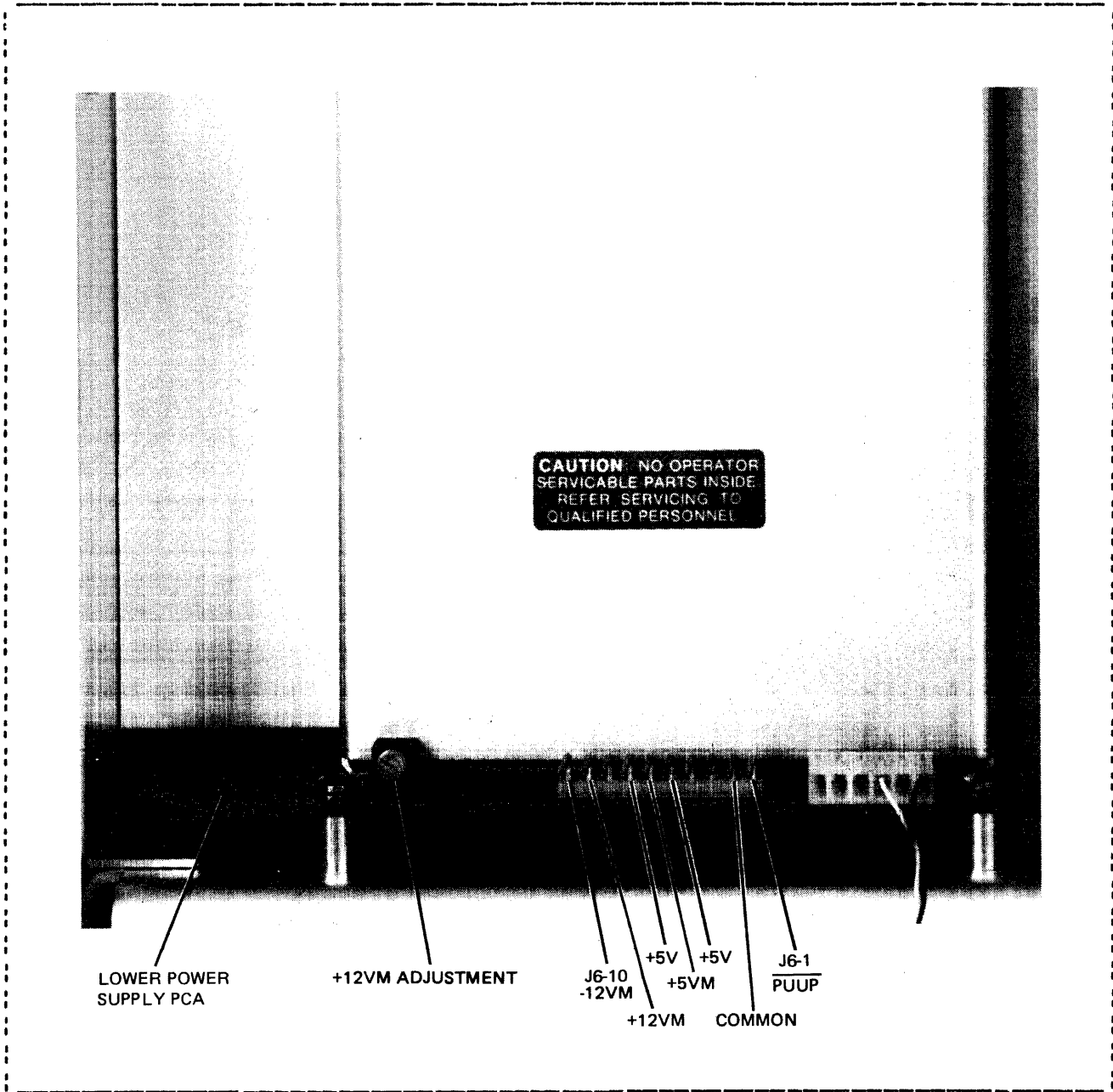
2-23. CLAIMS PROCEDURE

If the extender is damaged or fails to meet specifications, notify the nearest Hewlett-Packard Sales and Service Office. If damaged occurred in transit, notify the carrier also. Hewlett-Packard will arrange for replacement or repair without waiting for settlement of claims against the carrier. In the event of damage in transit, retain the packing carton and packaging materials for inspection.

2-24. REPACKING FOR SHIPMENT

CAUTION

The power fail recovery system battery must be discharged before shipment. This can best be accomplished by disconnecting the power cord, setting the BATTERY switch to the INT position, and allowing the internal battery to discharge approximately 3 hours. After the battery is discharged, disconnect the battery cables from the battery input receptacles mounted on the inner side of the rear panel.



7098-7

Figure 2-9. Power Supply Adjustment and Voltage Test Points

CAUTION

When shipping the extender with a power fail recovery system installed, secure the battery PCA in place with masking tape or equivalent.

2-25. SHIPMENT USING ORIGINAL PACKAGING

The same containers and materials used in factory packaging can be used for reshipment of the extender. Alternatively, containers and packing materials may be obtained from Hewlett-Packard Sales and Service Offices. If the extender is being sent to the factory for servicing, attach a tag to the extender specifying the type of service required together with the extender model number and full serial number. Mark the container "FRAGILE" to ensure careful handling. In any subsequent correspondence, refer to the extender by model number and full serial number.

2-26. SHIPMENT USING NEW PACKAGING

The following instructions should be used as a guide when packaging the extender with commercially available materials:

- a. Wrap extender in heavy paper or sheet plastic. If shipping the extender to Hewlett-Packard, first attach a tag to the extender with your return address and indicating the type of service required. Include the extender model number and full serial number.
- b. Use a strong shipping container. A double-wall carton constructed of 160 kilogram (350-pound) test material is adequate.
- c. Use sufficient shock-absorbing material on all sides of the extender to provide a firm cushion and to prevent movement inside the container. Use particular care to protect the extender corners and front and rear panels.
- d. Seal the shipping container securely and mark it "FRAGILE."
- e. In any subsequent correspondence with Hewlett-Packard, refer to the extender by model number and full serial number.

This section includes information for isolating malfunctions to the subassembly level and procedures for removing and replacing the various extender subassemblies. Also included is a power distribution diagram.

3-1. TROUBLESHOOTING

Extender malfunctions can be isolated to a subassembly level by performing in sequence the procedure presented in figure 3-1. When a malfunction is encountered, replace the first suspect subassembly and repeat that portion of the procedure where the malfunction occurred. (Subassembly removal and replacement procedures are given in the following paragraphs.) If the malfunction persists, reinstall the original subassembly, and again repeat the procedure. After the malfunction is cleared, contact the nearest Hewlett-Packard Sales and Service Office for instructions regarding shipment of the defective subassembly.

Attach a tag to the defective subassembly identifying the owner and specifying the type of malfunction. Include the model number and full serial number of your extender. Pack the defective subassembly in the packaging removed from the replacement subassembly, seal the shipping package, and mark it "FRAGILE" to ensure careful handling.

3-2. SUBASSEMBLY REMOVAL AND REPLACEMENT

WARNING

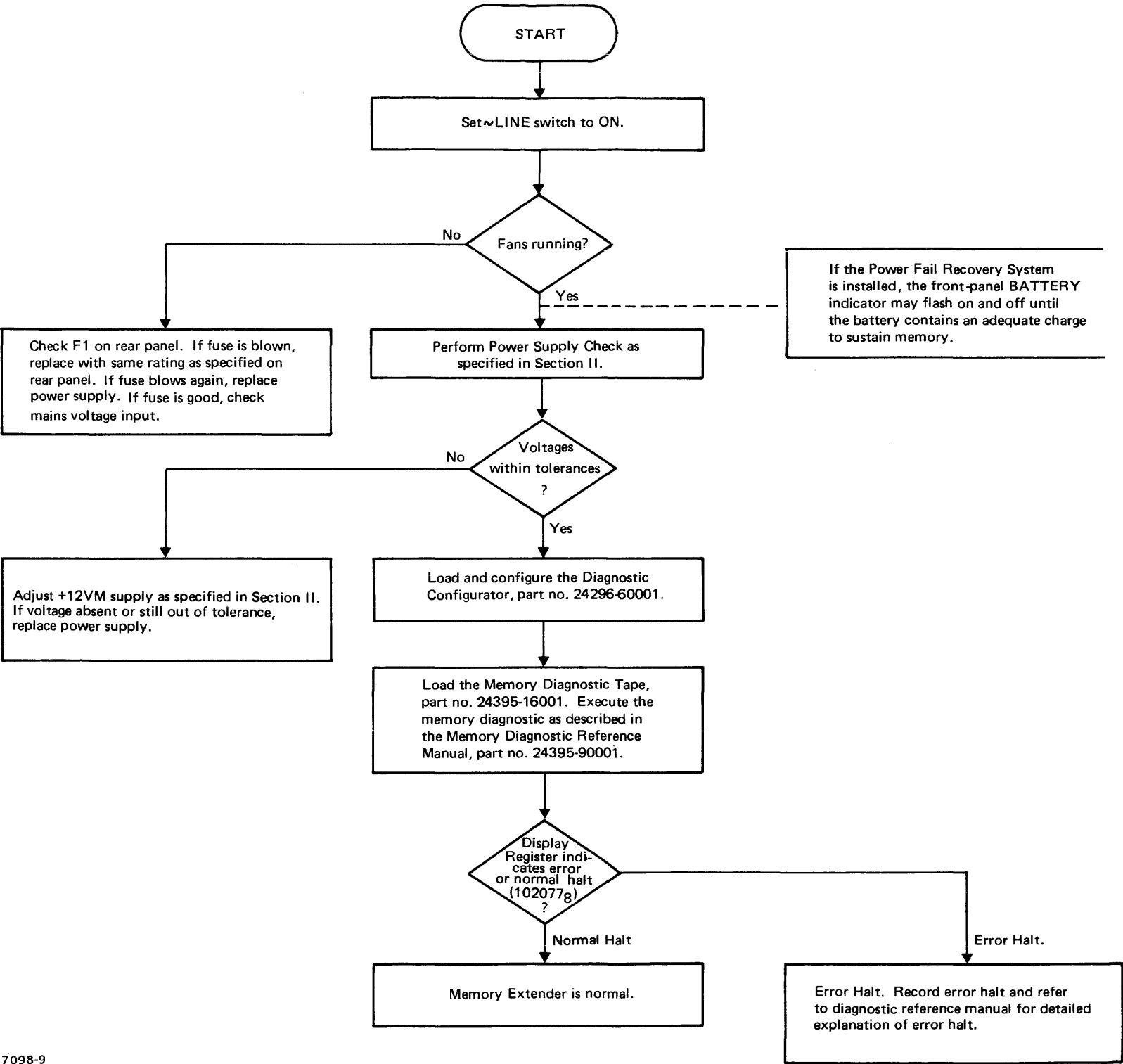
Hazardous voltages are present inside the extender mainframe. Use extreme caution when working around the power supply area. Heed all WARNING-HAZARDOUS VOLTAGE labels.

The following paragraphs, which describe procedures for removing and replacing various extender parts and subassemblies shown in figure 4-1, assume that the extender is installed as a freestanding device. If the extender is rack mounted, read the entire subassembly removal procedure and refer to figure 4-1. When it is obvious that the procedure cannot be performed with the extender in the rack, proceed as follows:

CAUTION

All contents of memory will be lost when the mains (line) and battery voltages are both off. Therefore, before proceeding, ensure that any contents of memory to be saved are stored in another medium for later retrieval.

- a. On extender rear panel, set $\sim$ LINE switch to OFF. If an internal battery is installed, set BATTERY switch to EXT; if an external battery is used, set BATTERY switch to INT and disconnect battery cables. Disconnect ac power cord and power control cable (figure 2-7).
- b. On computer rear panel, set $\sim$ LINE and BATTERY switches to OFF.
- c. Loosen quarter-turn fasteners on memory extender front panel and lower it to memory access position. (See figure 2-3.) Remove memory PCA cage cover by removing the two screws and lockwashers.
- d. Loosen quarter-turn fasteners on computer front panel and lower it to memory access position. Remove memory PCA cage cover by removing the two screws and lockwashers.
- e. Disconnect extender memory system cable and remove cable.
- f. Remove the screws that secure the front of the extender to the rack, close the front panel, and slide the extender out of the rack.
- g. Remove the extender from the chassis slides.
- h. To replace the extender in the rack, reverse the procedures contained in the previous steps.



7098-9

Figure 3-1. Troubleshooting Flowchart

3-3. TOP, SIDE, AND BOTTOM COVERS

WARNING

Hazardous voltages are exposed
when the covers are removed and
ac power is applied.

3-4. REMOVAL. Remove the top, side, and bottom covers as follows:

- a. If present, remove extender memory system cable.
- b. Loosen screw located on rear fold of top cover; slide cover towards rear and remove.
- c. If present, remove chassis slide(s) from side cover(s). Loosen screw on rear fold of side cover; slide cover towards rear and remove.
- d. Loosen screw located on rear fold of bottom cover; slide cover toward rear and remove.

3-5. REPLACEMENT. Replace the covers in the reverse order of the removal procedure.

3-6. MEMORY CAGE PCA's

3-7. REMOVAL. Remove the printed-circuit assemblies (PCA's) from the memory cage as follows:

- a. Loosen two quarter-turn fasteners on memory extender front panel and lower it to memory access position.
- b. Remove memory PCA cage cover by removing two screws and lockwashers.
- c. Disconnect extender memory system cable from all PCA's.
- d. Remove PCA by pulling forward on extractor levers.

3-8. REPLACEMENT. Replace memory PCA's in the reverse order of the removal procedure. When replacing a memory module, be sure to configure the memory module address jumpers correctly. Figures 2-4 and 2-5 illustrate the HP 2102A memory module address jumpers.

3-9. MEMORY BACKPLANE

3-10. REMOVAL. To remove the memory backplane, proceed as follows:

- a. Disconnect memory system cable from all PCA's in memory cage.
- b. Withdraw all memory PCA's approximately 2 inches (5 centimeters) to clear rear connectors from memory backplane receptacles.

- c. Loosen screws securing six wires to memory backplane and disconnect wires from memory backplane.
- d. Remove bolt securing memory backplane retainer to mainframe and withdraw memory backplane from mainframe.

3-11. REPLACEMENT. Replace the memory backplane in the reverse order of the removal procedure.

3-12. POWER FAIL RECOVERY SYSTEM

3-13. BATTERY REMOVAL. Remove the top cover from the extender. Set the BATTERY switch to EXT and disconnect the battery cables from the rear panel connectors. Remove the eight screws and lockwashers securing the cover to the battery housing. Remove the battery assemblies.

3-14. BATTERY PCA REMOVAL. Slide the extender top cover back to access the battery PCA. Grasp the battery PCA and pull it upward out of the board guides.

3-15. REPLACEMENT. Replace the batteries and battery PCA in the reverse order of the removal procedure.

3-16. POWER SUPPLY

WARNING

Hazardous voltages are present with the ac power cord connected. Ensure that the ac power cord is disconnected before proceeding.

3-17. REMOVAL. Remove extender top cover and proceed as follows:

- a. Loosen two quarter-turn fasteners on extender front panel and lower it to access position. On lower power supply PCA, disconnect cable that goes to front panel.
- b. Remove screw securing ground (black) wires to top of upper power supply PCA. Replace screw to secure only the ground wire going to memory backplane.
- c. Loosen screws securing wires to memory backplane and disconnect wires from backplane.
- d. Remove ground wires going to rear panel from wire harness.
- e. Remove seven screws and lockwashers securing rear panel to main frame. Four of these screws are inside mainframe (figure 4-1) and three are along bottom of rear panel.
- f. Remove four screws and lockwashers securing upper power supply PCA supports to left side of mainframe.

- g. Remove bolt, two screws and lockwashers securing power supply side shield to mainframe and remove shield.
- h. If present, remove battery PCA from power supply.
- i. Remove power supply front shield by removing screw and lockwasher.
- j. Remove eight long slot-head screws and lockwashers securing upper power supply PCA to mainframe.
- k. Remove front two screws and lockwashers securing lower power supply PCA to mainframe.
- l. Disconnect two connectors from lower power supply PCA.
- m. Disconnect connector from upper power supply PCA and unplug power cords from ventilating fans.
- n. Lift power supply up out of mainframe.

3-18. REPLACEMENT. Replace the power supply in the reverse order of the removal procedure.

3-19. VENTILATING FANS

WARNING

Hazardous voltages are present when working around the power supply area. Ensure that ac power is disconnected before proceeding.

3-20. REMOVAL. Remove the memory extender top and left side covers and proceed as follows:

- a. Disconnect the power lead at top of fan.
- b. Remove four screws securing fan to mainframe. Pull fan upward and out of mainframe.

3-21. REPLACEMENT. Replace the ventilating fan(s) in the reverse order of the removal procedure.

3-22. 110/220V AC RECONFIGURATION

To reconfigure the memory extender to operate from 220-volt mains instead of 110-volt mains (or vice versa), refer to figure 3-2 and proceed as follows:

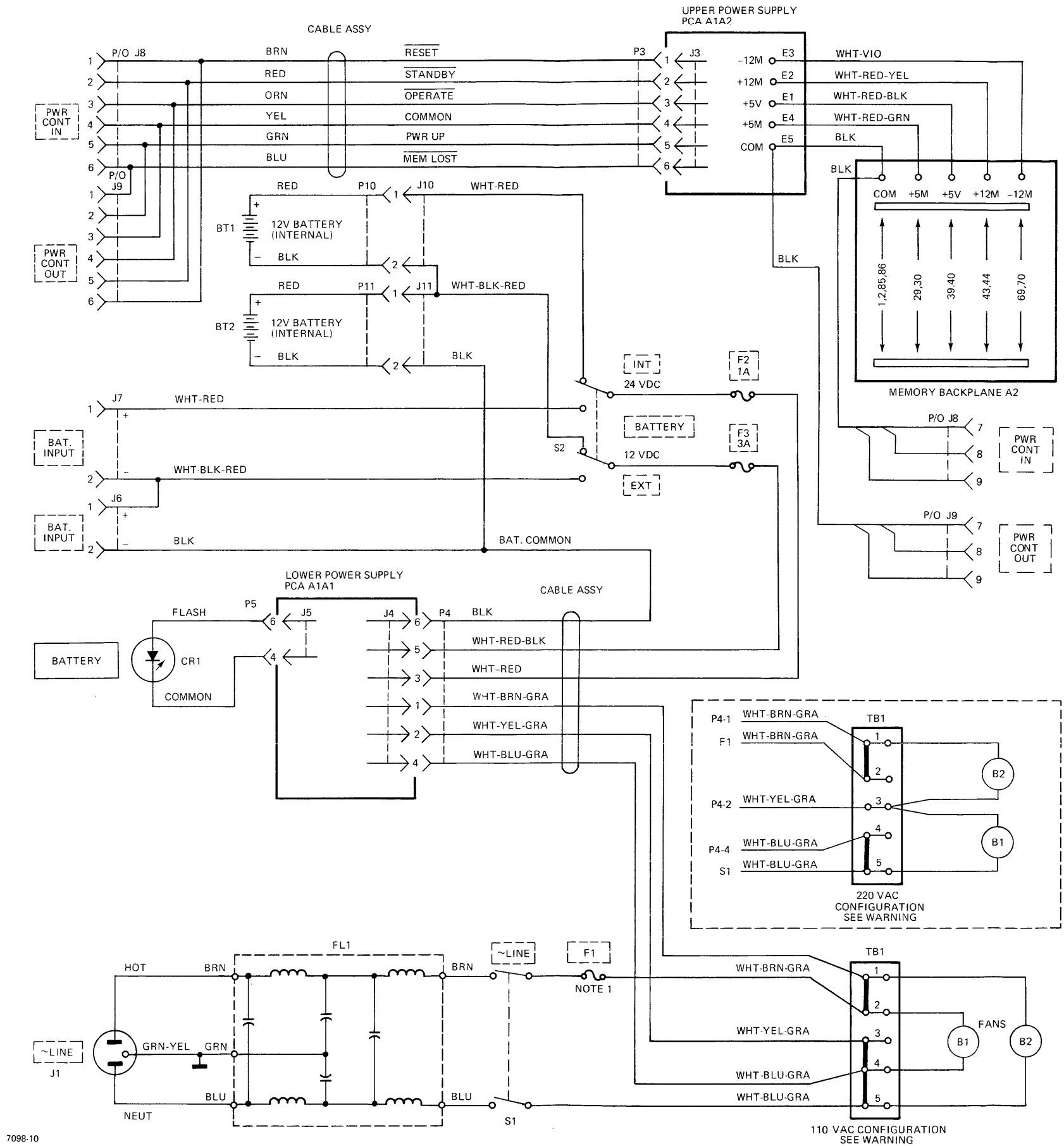
WARNING

Hazardous voltages are present inside the mainframe. Before changing from 110V AC to 220V AC, or vice versa, set ~LINE switch to OFF, BATTERY switch to EXT, and disconnect the power cord. Failure to observe this precaution can result in serious injury or death.

- a. On extender rear panel, set ~LINE switch to OFF. If an internal battery is installed, set BATTERY switch to EXT; if an external battery is used, set BATTERY switch to INT and disconnect battery cables. Disconnect ac power cord.
- b. Remove extender top cover.
- c. Remove seven screws and lockwashers securing rear panel to mainframe. Four of these screws are inside mainframe (figure 4-1) and three are long bottom of rear panel.
- d. Carefully swing the rear panel assembly outward to expose the terminal block, TBI, and other components mounted on this panel.
- e. For 110V AC operation, connect a jumper wire between the WHT-YEL-GRA and WHT-BLU-GRA lead wires on terminal block TBI. Connect one side of each fan to the WHT-BRN-GRA lead wire on TBI; connect other side of each fan to the WHT-BLU-GRA lead wire on TBI as shown in figure 3-2. Replace fuse F1 with the normal blow type and rating specified in table 4-1.
- f. For 220V ac operation, remove jumper wire between the WHT-YEL-GRA and WHT-BLU-GRA lead wires on terminal block TBI. Connect one fan across the WHT-BRN-GRA and WHT-YEL-GRA lead wires; connect other fan across the WHT-YEL-GRA and WHT-BLU-GRA lead wires as shown in figure 3-2. Replace fuse F1 with normal blow type and rating specified in table 4-1.
- g. Position rear panel in place and secure with the seven mounting screws and lockwashers.
- h. For the correct ac power cord set, refer to paragraph 2-9 and figure 2-1.

3-23. POWER DISTRIBUTION DIAGRAM

Figure 3-2 shows the wiring between the memory extender backplane, power supply, and other subassemblies in the extender.



- NOTES:
1. FUSE F1 RATED AT 4A FOR 110V; 2A FOR 220V.
 2. [REAR PANEL] DENOTES REAR PANEL NOMENCLATURE.
 3. [FRONT PANEL] DENOTES FRONT PANEL NOMENCLATURE.

WARNING

HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE EXTENDER MAINFRAME! BEFORE CHANGING FROM 110 VAC TO 220 VAC, OR VICE VERSA, SET [~LINE] AND [BATTERY] SWITCHES TO OFF AND *DISCONNECT THE POWER CORD!!* FAILURE TO OBSERVE THIS PRECAUTION CAN RESULT IN SERIOUS INJURY OR DEATH!

Figure 3-2. Power Distribution Diagram

This section provides a field-replaceable parts listing of the HP 12990A Memory Extender. Component parts of printed-circuit assemblies (PCA's) are not included, since these parts are considered replaceable only at the factory or a depot.

4-1. REPLACEABLE PARTS

The parts are listed in table 4-1 and illustrated in figure 4-1. The columns in table 4-1 provide the following information for each part:

- a. FIG. & INDEX NO. The figure and index number where the replaceable parts are shown in an exploded view.
- b. HP PART NO. The Hewlett-Packard part number for each replaceable part.
- c. DESCRIPTION. The description of each replaceable part. One asterisk denotes a part or an assembly; two asterisks denote a sub-assembly or an attaching part of the previous assembly having one asterisks.
- d. MFR. CODE. A five-digit code that denotes the manufacturer of the part.
- e. MFR. PART NO. The manufacturer's part number for each replaceable part.
- f. UNITS PER ASSY. The total number of each replaceable part of the memory extender.

4-2. ORDERING INFORMATION

To order replaceable parts, address the order to the local Hewlett-Packard Sales and Service Office listed at the end of this manual.

The following information should be included in the order for each replaceable part:

- a. Complete model number (including options and accessories) and serial number.
- b. Hewlett-Packard part number for each part.
- c. Complete description for each part as provided in the replaceable parts list.

Table 4-1. HP 12990A Memory Extender Replaceable Parts

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
4-1-	12990A	MEMORY EXTENDER	28480	12990A	
1	12990-60001	*Backplane Assy	28480	12990-60001	1
2	12990-60002	*Power Supply	28480	12990-60002	1
3	12990-60003	*Rear Panel Assy	28480	12990-60003	1
4	0360-0624	**Terminal Block TBI	28480	0360-0624	1
5	2110-0055	**Fuse F1, 4A, Normal Blow (110V operation)	28480	2110-0055	1
	2110-0002	**Fuse F1, 2A, Normal Blow (230V operation)			
6	2110-0001	**Fuse F2, 1A, Normal Blow	28480	2110-0001	1
7	2110-0003	**Fuse F3, 3A, Normal Blow	28480	2110-0003	1
8	3101-0046	**Toggle Switch S1	28480	3101-0046	1
9	9135-0030	**Mains Filter	28480	9135-0030	1
10	3101-0011	**Slide Switch S2	28480	3101-0011	1
11	1251-2357	**Mains Power Connector	28480	1251-2357	1
12	12990-60006	*Front Panel Assy	28480	12990-60006	1
13	1990-0518	**Light-Emitting Diode CRI	28480	1990-0518	1
14	1450-0167	**Lampholder	28480	1450-0167	1
15	02108-00017	*Side Cover	28480	02108-00017	1

Table 4-1. HP 12990A Memory Extender Replaceable Parts (Continued)

FIG. & INDEX NO.	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	UNITS PER ASSY
16	02108-00012	*Memory Cage Cover	28480	02108-00012	1
17	3160-0218	*Ventilating Fan	28480	3160-0128	2
18	5020-7335	*Front Frame	28480	5020-7335	1
19	5020-8808	*Rear Frame	28480	5020-8808	1
20	12990-60011	*Memory System Cable	28480	12990-60011	1
	Note 1	*Power Fail Recovery System			
21	02112-60003	**Battery PCA	28480	02112-60003	1
22	1420-0206	**Battery	28480	1420-0206	2
Note 1. Memory extender accessory. Refer to paragraph 1-3.					

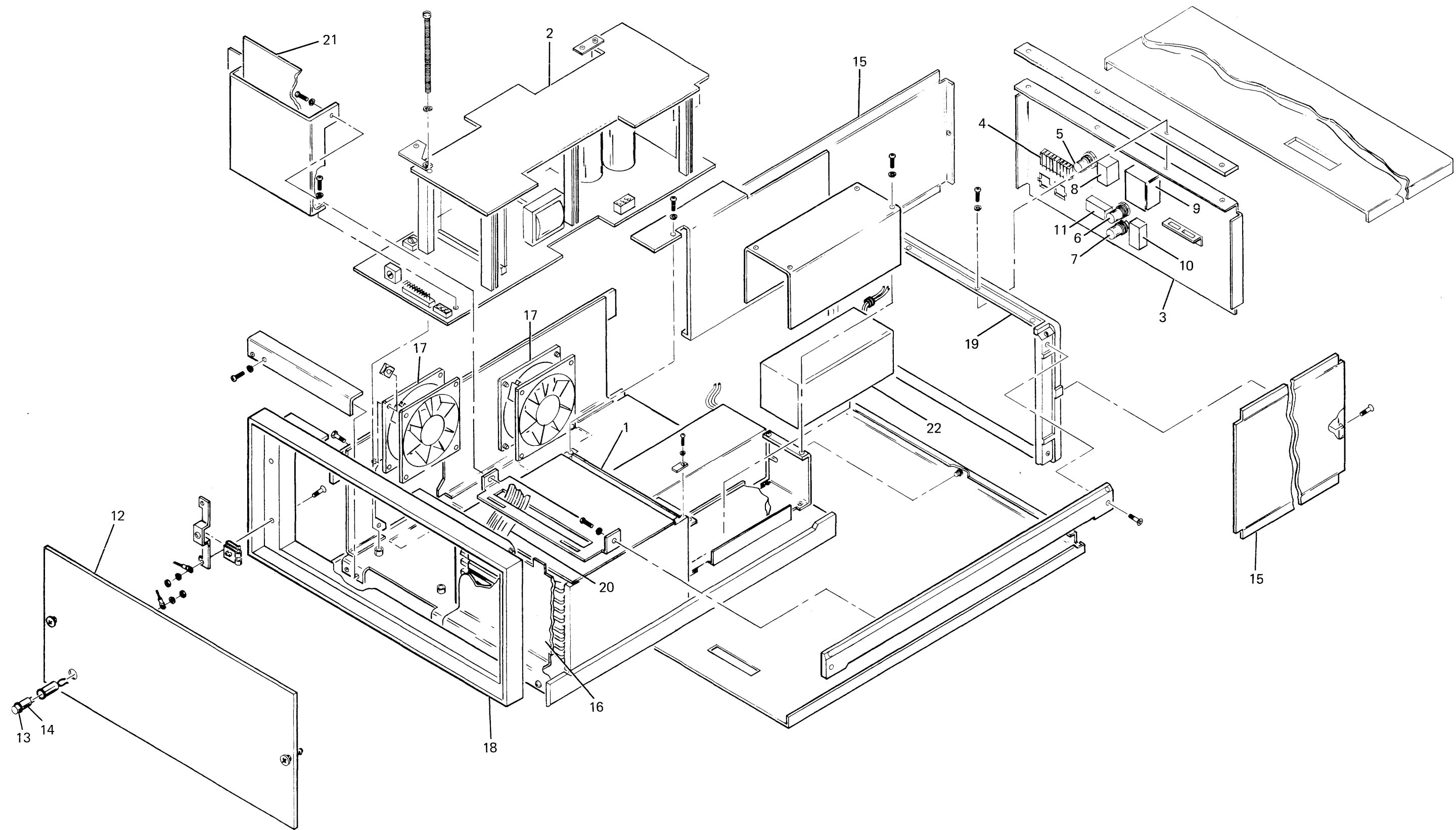


Figure 4-1. HP 12990A Memory Extender Exploded View

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